nucleotide base sequence are fixed, said second electrode is arranged opposite to said first electrode with a predetermined distance, said second plate consists of a light-transmissive material, and said second electrode is transparent;

a voltage applying unit connected to said polynucleotide cell for applying a voltage between said first electrode and said second electrode; and

D1 cont.

an optical detector adjacent said polynucleotide cell for detecting an electrochemiluminescence (ECL) generated from an ECL label resulting from the application of said voltage, to detect target polynucleotides which are trapped by hybridization between said DNA probes fixed to said areas and said target polynucleotides,

wherein at least one species of base labeled with said ECL label is applied to extend said hybridized DNA probes.

31. (Amended) A polynucleotide assay apparatus according to claim 30, wherein at least the one species of base labeled with said ECL label is applied in an extending reaction and said each of said DNA probes has phosphorothioate bonds.

36. (Amended) A polynucleotide assay apparatus comprising:

D2

a polynucleotide detecting cell provided with a base plate whereon a first comb-shaped electrode and a second comb-shaped electrode are formed, wherein the surface of said first comb-shaped electrode is divided into plurality of areas, DNA probes having a different nucleotide base sequence are fixed to each of said areas, teeth of first comb-shaped electrode and teeth of second comb-shaped electrode are arranged in alternate repetition in parallel;

a voltage applying unit connected to said polynucleotide cell for applying a voltage between said first comb-shaped electrode and said second comb-shaped electrode; and

an optical detector adjacent said polynucleotide cell for detecting an electrochemiluminscence (ECL) generated from an ECL label resulting from the application of said voltage; to detect target polynucleotides which are trapped by hybridization between said DNA probes fixed to said areas and said target polynucleotides,

wherein at least one species of base labeled with said ECL label is applied to extend said hybridized DNA probes.

37. (Amended) A polynucleotide assay apparatus according to claim 36, wherein at least the one species of

D2 Cont

base labeled with said ECL label is applied in an extending reaction and said each of said DNA probes has phosporothioate bonds.

39. (Amended) A polynucleotide assay apparatus comprising:

a polynucleotide detecting cell provided with a base plate whereon a first comb-shaped electrode and a plurality of second electrodes are formed, wherein the surface of said first comb-shaped electrode is divided into plurality of areas, DNA probes having a different nucleotide base sequence are fixed to each of said areas, each of said second electrodes is separated from said first comb-shaped electrode and is arranged between teeth of said first comb-shaped electrode, and said first comb-shaped electrode and said second electrodes are arranged in alternate repetition in parallel at equal intervals in one direction;

D3

a voltage applying unit connected to said polynucleotide cell;

electrode selectors connected between said polynucleotide cell and said voltage applying unit for selecting an electrode out of said second electrodes;

said voltage applying unit applying a voltage between said first comb-shaped electrode and said selected second electrode;

an optical detector adjacent said polynucleotide cell for detecting an electrochemiluminescence (ECL) generated from an ECL label resulting from the application of said voltage, to detect target polynucleotides which are trapped by hybridization between said DNA probes fixed to said areas and said target polynucleotides, and

D3 cont.

a device connected to said voltage applying unit for controlling the duration of the application of said voltage on the basis of the velocity of the expansion of a region in which said ECL occurs and the distance between the center line of each of teeth of said first comb-shaped electrode arranged in alternate repetition in said one direction and the center line of each of said second electrodes in said one direction,

wherein at least one species of base labeled with said ECL label is applied to extend said hybridized DNA probes.

40. (Amended) A polynucleotide assay apparatus according to claim 39, wherein at least the one species of base labeled with said ECL label is applied in an extending

D3 Cont.

reaction and said each of said DNA probes has phosphorothioate bonds.

45. (Amended) A polynucleotide assay apparatus comprising:

D4

a polynucleotide detecting cell provided with a first plate whereon a first electrode is formed and a second plate whereon a second electrode is formed, wherein the surface of said first electrode is divided into plurality of areas, to each of which DNA probes having a different nucleotide base sequence are fixed, said second electrode is arranged opposite to said first electrode with a predetermined distance, said second plate consists of a light-transmissive material, and said second electrode is transparent;

a power source connected to said polynucleotide cell which applies a voltage between said first electrode and said second electrode;

a power source controller connected to said power source which controls the duration application of said voltage;

a TV camera adjacent said polynucleotide cell having a plurality of pickup elements which detects, as a 2D image, an electrochemiluminescence (ECL) generated from an ECL labeled with a base which is applied to extend DNA probes

hybridized with target polynucleotides by an extending reaction at said areas resulting from the application of said voltage, to detect the presence or absence of any extended chain generated by said extending reaction, for detecting said target polynucleotides which are trapped by hybridization between said DNA probes fixed to said areas and said target polynucleotides; and

Dep Cont

an optical system which connects optically said polynucleotide detecting cell and said pickup elements.

46. (Amended) A polynucleotide assay apparatus according to claim 45, wherein at least one species of base labeled with said ECL label is applied in an extending reaction and said each of said DNA probes has phosphorothioate bonds.

47. (Amended) A polynucleotide assay apparatus comprising:

a polynucleotide detecting cell provided with a base plate whereon a first electrode and a plurality of second electrodes are formed, wherein the surface of said first electrode is divided into plurality of areas, to each of which DNA probes having a different nucleotide base sequence are fixed, each of said second electrodes is separated from and surrounded by said first electrode, and arranged in a central

part of each of said areas, and arranged at equal intervals in two directions;

a power source connected to said polynucleotide cell which applies a voltage between said first electrode and said second electrode;

Dy Cont.

a CCD camera adjacent said polynucleotide cell which detects, as a 2D image an electrochemiluminescence (ECL) generated from an ECL labeled with a base which is applied to extend DNA probes hybridized with target polynucleotides by an extending reaction at said areas resulting from the application of said voltage, to detect the presence or absence of any extended chain generated by said extending reaction, for detecting said target polynucleotides which are trapped by hybridization between said DNA probes fixed to said areas and said target polynucleotides; and

a controller connected to said power source and said CCD camera which controls application of said voltage by said power source and reading of signals accumulated in said CCD camera.

48. (Amended) A polynucleotide assay apparatus according to claim 47, wherein at least one species of base labeled with said ECL label is applied in an extending